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Risk Management Tools for the Design Professional

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Building Commissioning: Process Types & Definitions

By Steven J. Nargang, PE

Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities and systems meets defined objectives and criteria. It is a quality-based method that is adopted by the building Owner to achieve successful construction, and it is not intended to be an additional layer of construction or project management. When applied comprehensively, the purpose is to reduce the overall cost of a construction project and increase long-term value to the building owners, occupants, and users, better ensuring reliability of performance.

New Building Commissioning (Cx)

The purpose of New Building Commissioning (Cx) is to facilitate and verify proper system performance of a new building. The Process begins at project inception (during the Pre-Design Phase) and continues for the life of the facility (through the Occupancy and Operations Phase).

Why should Building Commissioning be done?

ASHRAE performed a study of 60 commercial buildings and found that more than half suffered temperature control problems, 40% had problems with HVAC equipment and one-third had sensors that were not operating properly. Amazingly, 15% of the buildings were actually missing specified equipment.

The Commissioning Process is intended to reduce the project capital cost through the first year of operation. It also reduces the life-cycle cost of the facility. By utilizing this process a fully functional, fine-tuned facility is provided, with complete documentation of its systems/assemblies, and with operators and maintenance personnel fully trained.

Building commissioning is of greatest value to the owner when it provides a means of continuously communicating their building systems criteria and rigorously verifying compliance with them, throughout the many phases of design and construction.

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ProNetwork News
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Prior to design, the Commissioning Authority (CxA) will assist the Owner in evaluating the facility's requirements regarding such issues as energy conservation, indoor environment, staff training, and operation and maintenance.

What are the major process components of New Building Commissioning?

Review all phases of design and construction documents for these areas:

a. Compliance with design criteria
b. Commissioning requirements
c. Bidding issues
d. Construction coordination and installation concerns
e. Performance aspects
f. Facilitation of operations and maintenance, including training and documentation
g. Review the equipment submittals for compliance with commissioning issues
h. Verify the scheduling and procedures used for system start-up
i. Verify training of owner's operating staff is conducted per document's requirements
j. Verify operations and maintenance manual's compliance with contract documents
k. Prior to expiration of the construction contract warranty, assist the owner in assessing systems' performance and addressing related issues

The LEED rating system implicitly requires the use of an integrated design approach (bringing together the entire design, commissioning, and construction team at the start of the project) to design and construct a building that can attain LEED certification. This truly holistic approach to building design and construction is assured success with CxA involvement in the project. The role of the CxA is vital in this process, since the CxA is the extra set of eyes during the design phase who tests the building systems to ensure they operate at their designed high-performance levels.

Please Note:

- *An independent CxA is a fundamental requirement of LEED certification process.*
- *Commissioning of buildings is a requirement of the IECC 2007.*

What are the benefits to the Owners and Facility Managers of new buildings?

1. Lower operating costs due to improved operation techniques
2. Benefits to building occupants, including greater worker productivity, reduced complaints, and reduced incidence of absenteeism
3. Improved operator knowledge of how to optimize the facility operation and maintenance due to the early inclusion of operators in the commissioning process
4. Reduces training requirements due to continuously updated documentation of how systems should operate and be maintained; personnel will only need to be trained with regard to changes
5. Facility performance is in accordance with the Owner's Project Requirements
6. Systems Manual provides an easy reference document for system and assembly operation and maintenance
7. Reduces downtime due to better diagnosis of failures
8. Improves ability to provide accurate information on facility's operation and maintenance

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ProNetwork News

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Existing Building Commissioning -- Retro-Commissioning (RCx)

Existing building commissioning, or Retro- Commissioning (RCx), seeks to improve performance of existing facilities.

Ongoing RCx, or Continuous commissioning, emphasizes preventative maintenance.

How do we define Retro-Commissioning and identify the primary goals?
Retro-commissioning is a systematic process to improve an existing building's performance. Using a whole-building systems approach, retro-commissioning seeks to identify operational improvements that will increase occupant comfort and save energy. The process can be performed alone or with a retrofit project. Typical energy savings are between 5 percent and 20 percent, often with paybacks of less than one year.

The goals and objectives for applying the process (and level of rigor) may vary depending on the current needs of the owner, budget, and condition of the equipment. The retro-commissioning process most often focuses on dynamic energy-using systems, with the goal of reducing energy waste, obtaining energy cost savings, and identifying and fixing existing problems.

Why perform Retro-Commissioning, and what are the expected benefits?
Building performance problems are pervasive. Deficiencies such as deferred maintenance, construction defects, malfunctioning equipment, and design flaws have a host of ramifications, ranging from equipment failure, to compromised indoor air quality and comfort, to unnecessarily elevated energy use or under-performance of energy-efficiency strategies.

Facilities managers are sometimes skeptical about the full cost benefits of retro-commissioning. But according to a 2005 study called "The Cost-Effectiveness of Commissioning New and Existing Commercial Buildings: Lessons from 224 Buildings," the average ROI / payback for retro-commissioning was 8.5 months. (*refs: Lawrence Berkeley National Laboratory, PECI and the Energy Systems Laboratory at Texas A&M University*).

What are the major process components of the Retro-commissioning Process?
Retro-commissioning provides an inclusive and systematic process that intends not only to optimize how equipment and systems operate, but also to optimize how the systems function together. Although a complete retro-commissioning process may include recommendations for capital improvements, the primary focus is on using O&M tune-up activities and diagnostic testing to optimize the building systems.
Retro-commissioning:

- Provides a systematic method of identifying operational and maintenance improvements in dynamic systems
- Optimizes existing system performance, rather than major equipment replacement
- Often focuses on energy or specific problems
- Is not a substitute for major repair work; repairing major problems is a must before retro-commissioning can be fully completed

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Risk Management Tools for the Design Professional

Selecting a consulting firm to provide RCx services:
A potential firm should be selected based not only on its references, but also on its approach. Its focus that should be more technical and less management-oriented when compared to new Cx.
The consulting firm should be highly experienced with following commissioning issues:
1. Troubleshooting
2. Balancing
3. Controls
4. Design
5. Equipment
6. Energy

What are the benefits to the Owners and Facility Managers of existing buildings?
1. Reduction in energy utility costs
2. Enhanced indoor environmental quality
3. Better system control
4. Resolution of specific problems
5. Direct cost benefits, including:
   - *Energy savings*: 15% on average
   - *Return on Investment / Payback*: Less than 1 year, on average
   - *Miscellaneous non-energy benefits*: $0.18 per square foot
6. Increased equipment life and efficiency
7. Greater comfort for occupants

To properly commission the equipment and systems of a building facility, a consulting firm must have a strong understanding of design principles, installation issues, construction processes and functional testing procedures. Having system design experience is a strong advantage.

Broker's Notes

Moore Insurance Services is a member of a/e ProNet a national association of insurance agents/brokers that specialize in providing risk management and insurance services to design professionals. These services included risk management publications, contract language review tools, seminar materials and other useful information to help design professionals manage their risks.

Moore Insurance Services offers many professional liability and property & casualty insurance programs. Many of these programs are endorsed or commended by the professional associations and organizations that we support including: The American Institute of Architects (AIA), National Society of Professional Engineers (NSPE), American Council of Engineering Companies (ACEC), Michigan Association of Environmental Professionals (MAEP) and Michigan Society of Professional Surveyors (MSPS).

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